US 6,353,895 B2

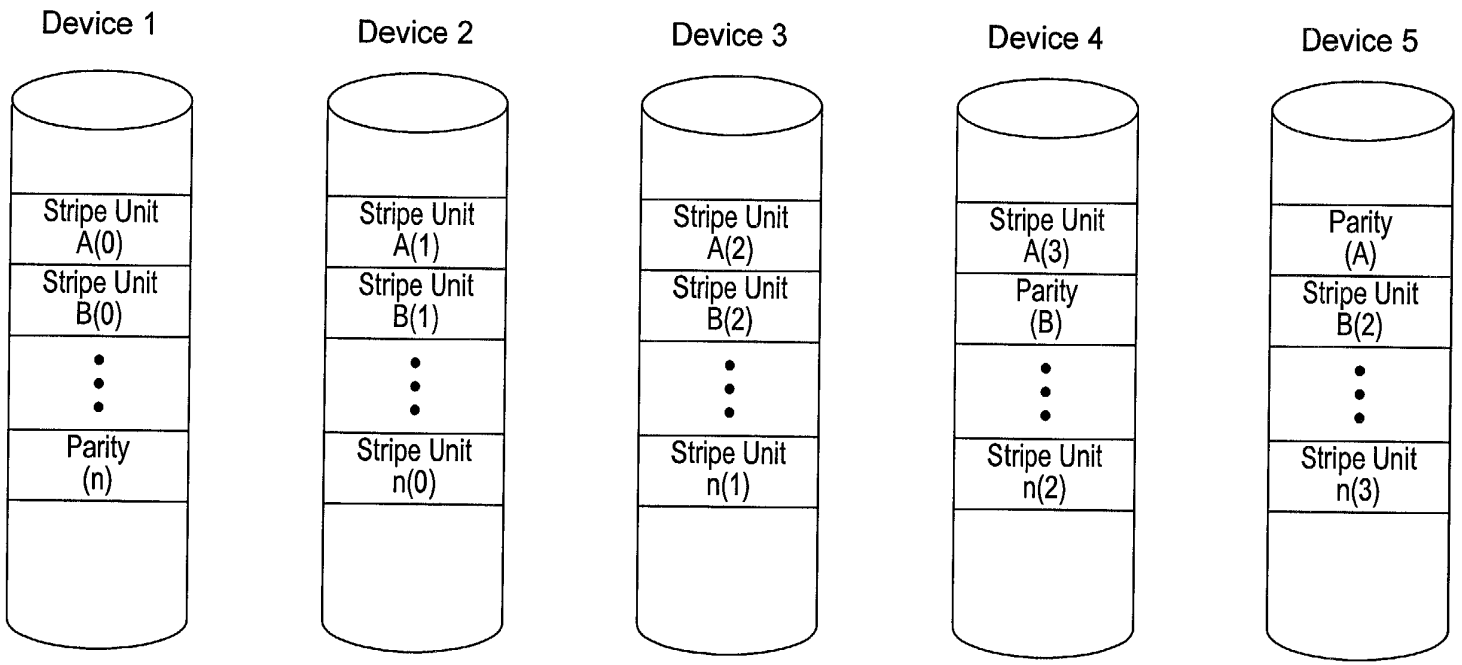

FIG. 1
(Prior Art)

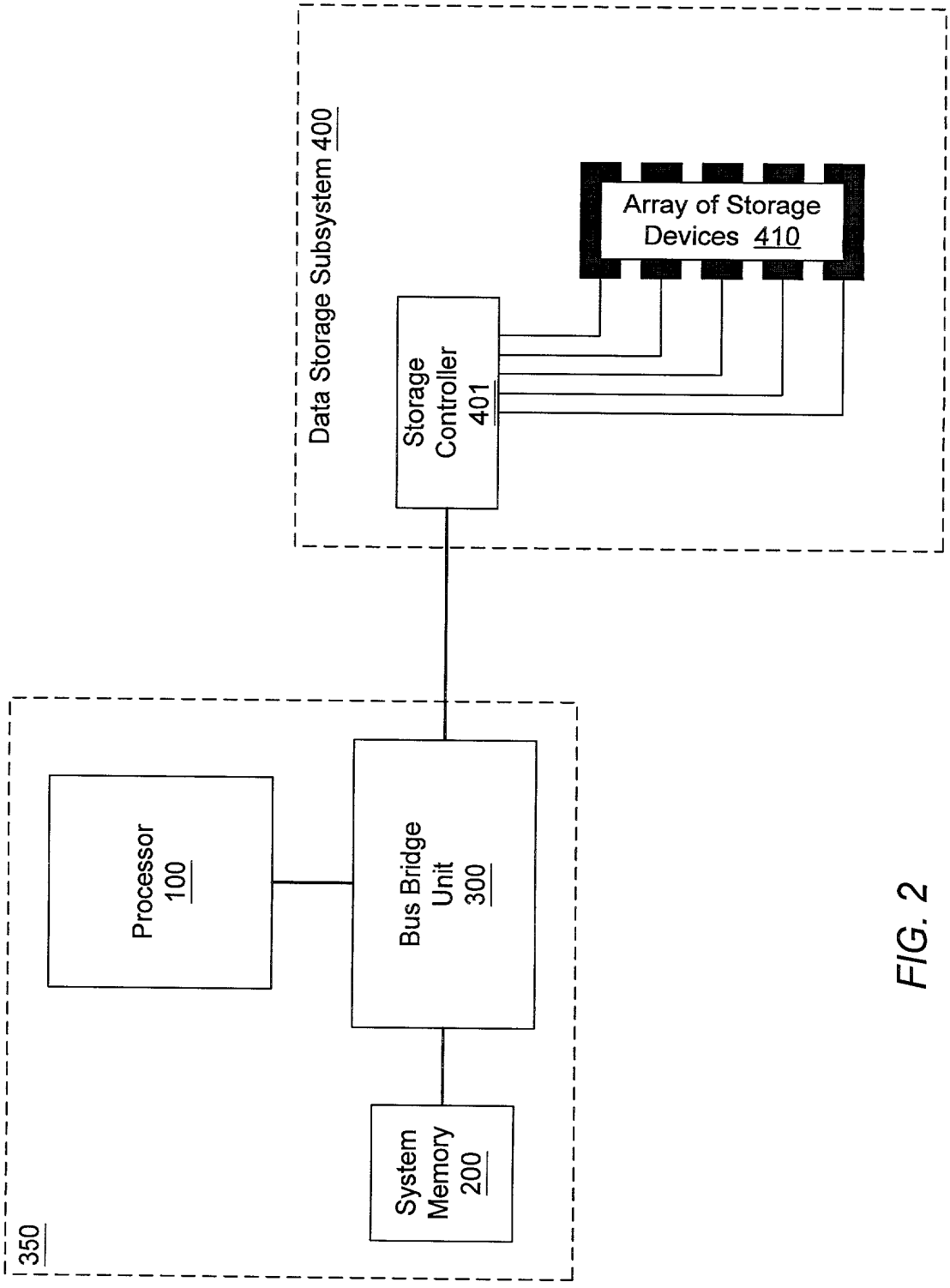
Data Storage Subsystem 400
Array of Storage Devices 410
Storage Controller 401
Processor 100
Bus Bridge Unit 300
System Memory 200
350

FIG. 2

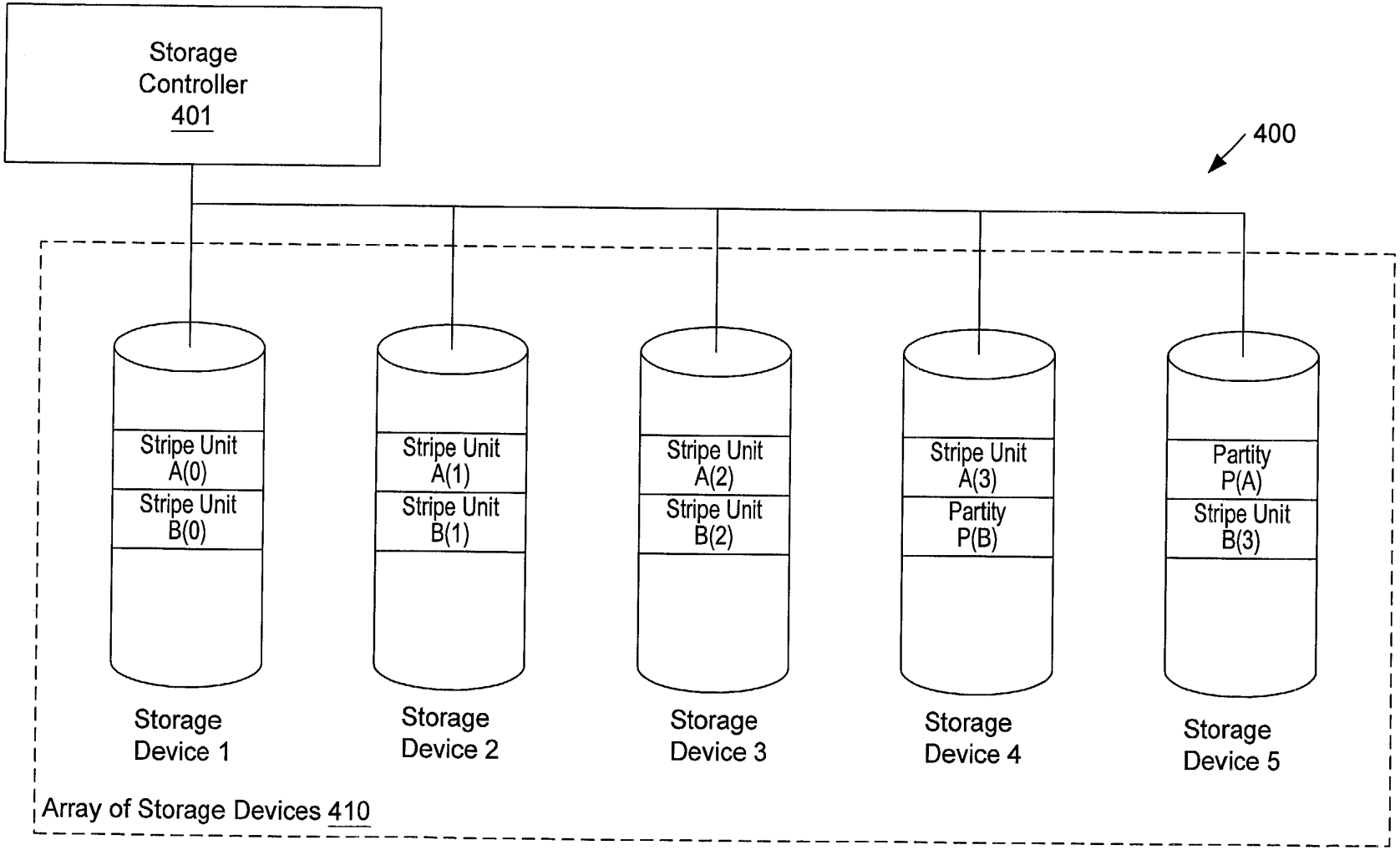
Storage Controller 401
400
Stripe Unit A(0)
Stripe Unit B(0)
Stripe Unit A(1)
Stripe Unit B(1)
Stripe Unit A(2)
Stripe Unit B(2)
Stripe Unit A(3)
Partity P(B)
Partity P(A)
Stripe Unit B(3)
Storage Device 1
Storage Device 2
Storage Device 3
Storage Device 4
Storage Device 5
Array of Storage Devices 410

FIG. 3

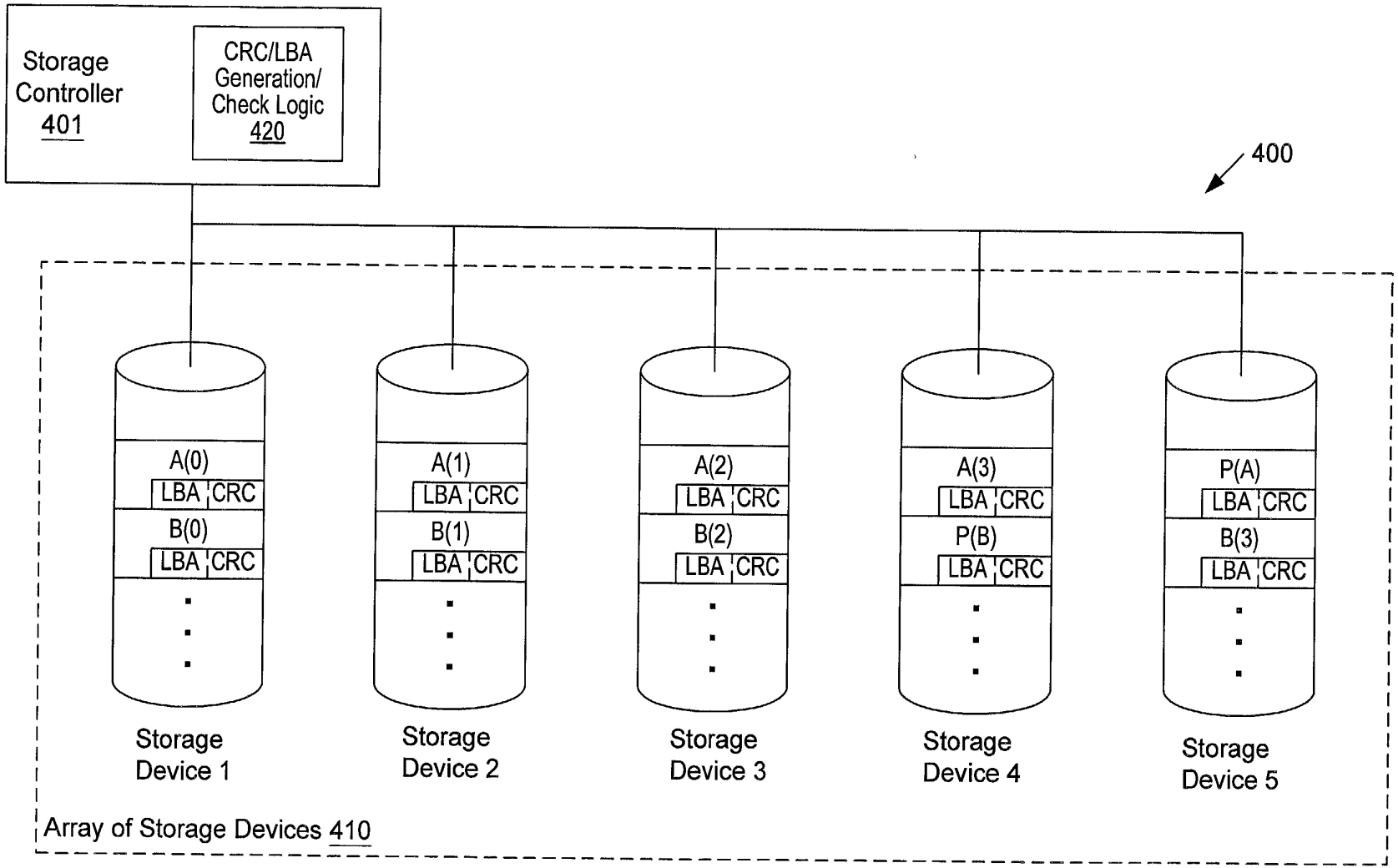
Storage Controller 401
CRC/LBA Generation/ Check Logic 420
400
A(0)
LBA CRC
B(0)
LBA CRC
A(1)
LBA CRC
B(1)
LBA CRC
A(2)
LBA CRC
B(2)
LBA CRC
A(3)
LBA CRC
P(B)
LBA CRC
P(A)
LBA CRC
B(3)
LBA CRC
Storage Device 1
Storage Device 2
Storage Device 3
Storage Device 4
Storage Device 5
Array of Storage Devices 410

FIG. 4

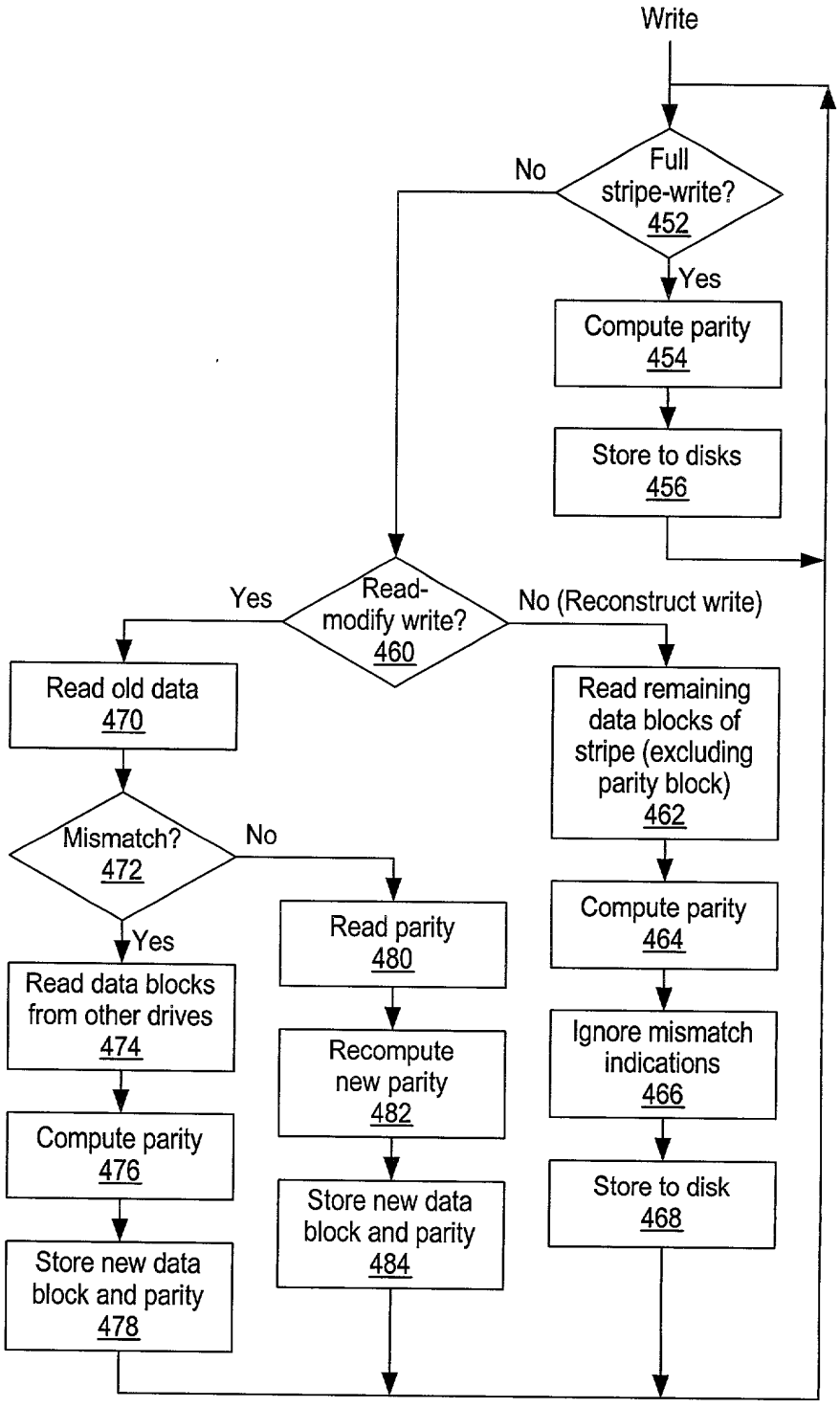
Write
Full stripe-write? 452
No
Yes
Compute parity 454
Store to disks 456
Read-modify write? 460
Yes
No (Reconstruct write)
Read old data 470
Mismatch? 472
No
Yes
Read data blocks from other drives 474
Compute parity 476
Store new data block and parity 478
Read parity 480
Recompute new parity 482
Store new data block and parity 484
Read remaining data blocks of stripe (excluding parity block) 462
Compute parity 464
Ignore mismatch indications 466
Store to disk 468

FIG. 5

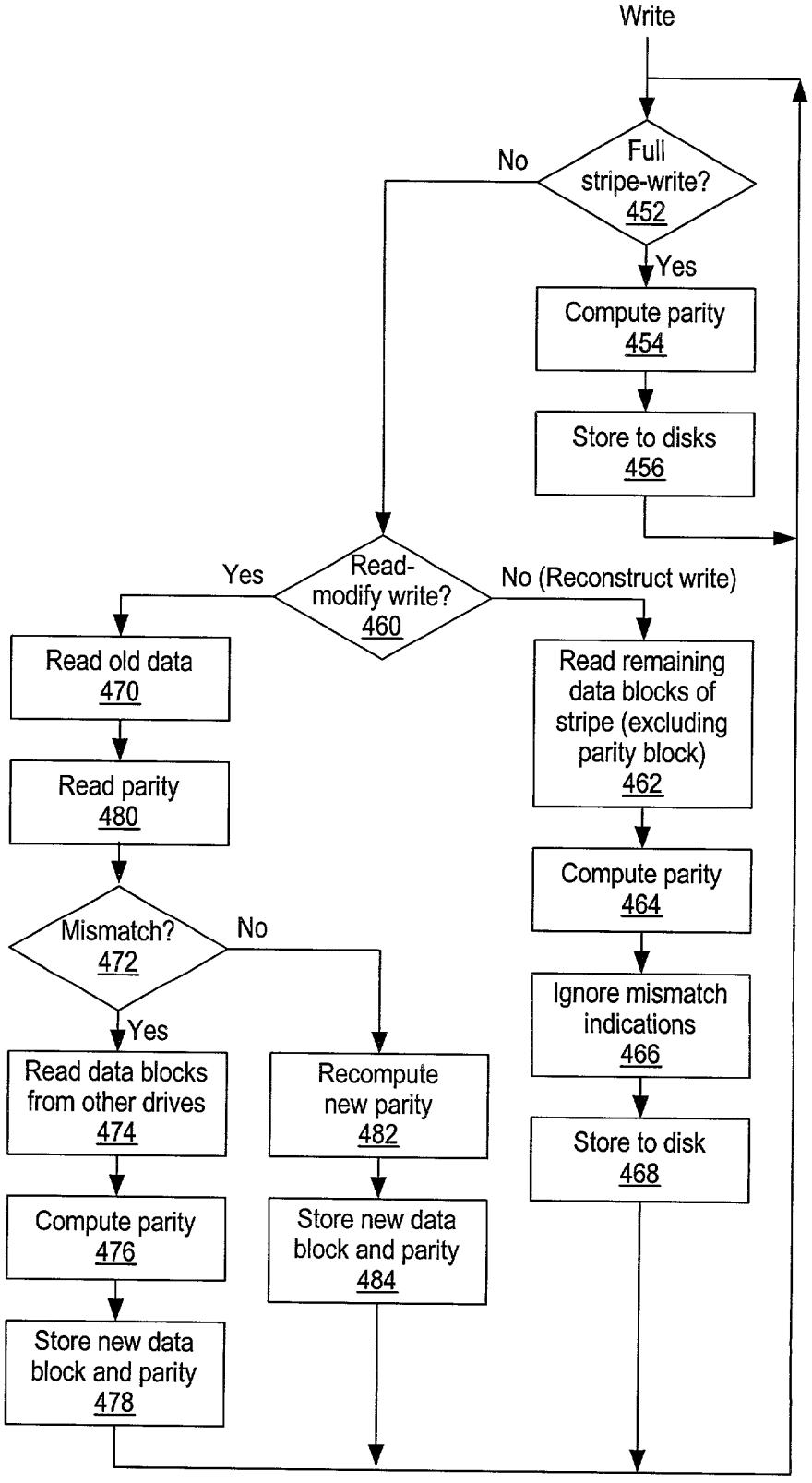
Write
Full stripe-write? 452
No
Yes
Compute parity 454
Store to disks 456
Read-modify write? 460
Yes
No (Reconstruct write)
Read old data 470
Read parity 480
Mismatch? 472
No
Yes
Read data blocks from other drives 474
Compute parity 476
Store new data block and parity 478
Recompute new parity 482
Store new data block and parity 484
Read remaining data blocks of stripe (excluding parity block) 462
Compute parity 464
Ignore mismatch indications 466
Store to disk 468

FIG. 6

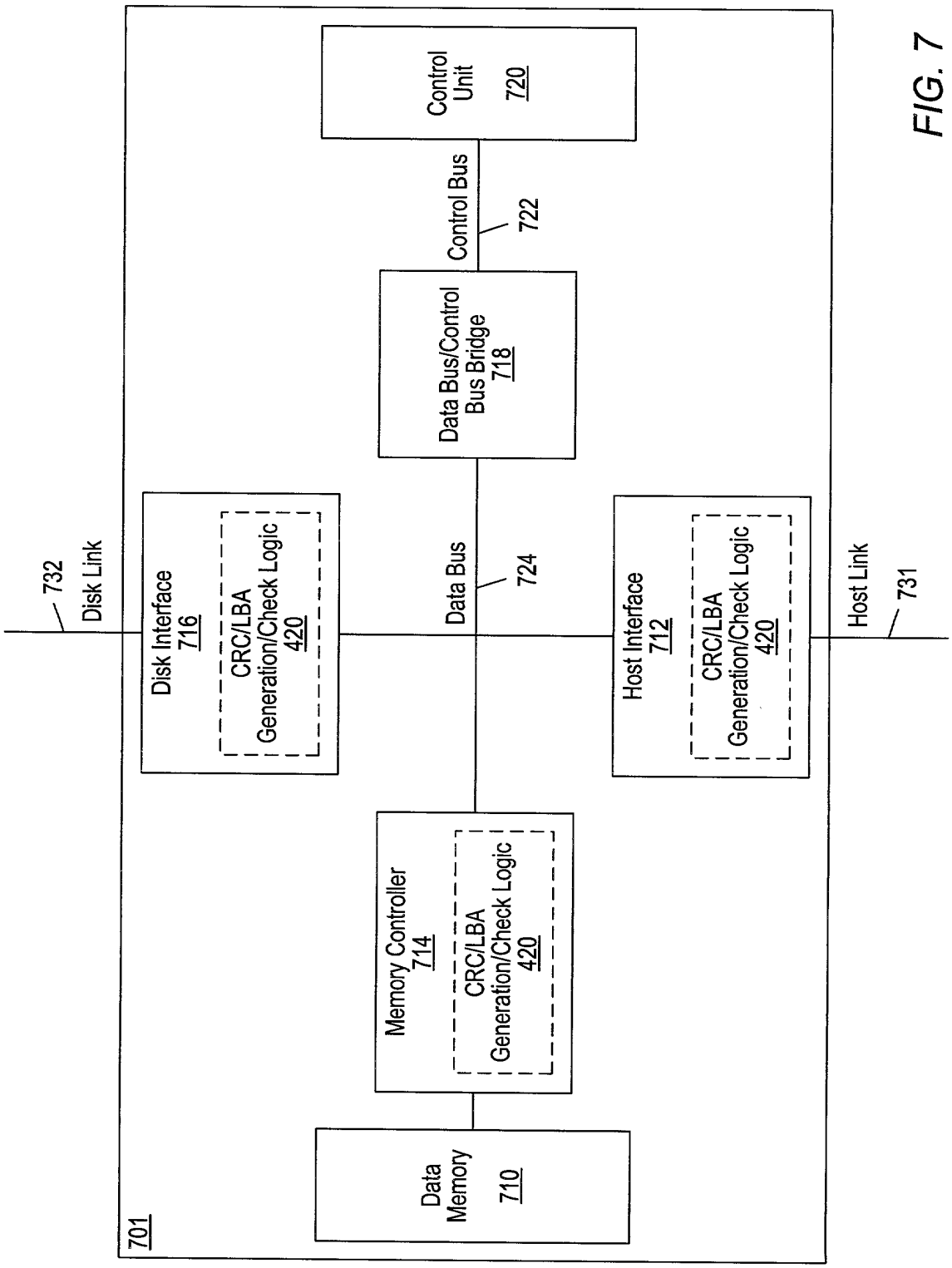
701
Data Memory 710
Memory Controller 714
CRC/LBA Generation/Check Logic 420
Disk Interface 716
CRC/LBA Generation/Check Logic 420
732
Disk Link
Data Bus 724
Data Bus/Control Bus Bridge 718
Control Bus 722
Control Unit 720
Host Interface 712
CRC/LBA Generation/Check Logic 420
Host Link 731

FIG. 7